A STUDY ON PEAK EXPIRATORY FLOW RATE IN PATIENTS WITH TYPE II DIABETES MELLITUS

DISSERTATION

Submitted to

The Tamilnadu Dr. MGR Medical University

In partial fulfillment for the degree of

MASTER OF PHYSIOTHERAPY

(Advanced P.T. in Cardio-Respiratory Disease)

Cherraan's College of Physiotherapy

Cherraan's Institute of Health Sciences

Coimbatore, Tamilnadu, India

APRIL- 2012

CERTIFICATE

The work embodied in the thesis entitled "**A STUDY ON PEAK EXPIRATORY FLOW RATE IN PATIENTS WITH TYPE II DIABETES MELLITUS "submitted to The Tamilnadu Dr. MGR Medical University, Chennai** in partial fulfillment for the degree of **MASTER OF PHYSIOTHERAPY (ADVANCED P.T. IN CARDIO- RESPIRATORY DISEASE)**was carried out by candidate bearing register number **27103012** at Cherraan's College of Physiotherapy, Coimbatore under my supervision. This is an original work done by him and has not been submitted in part or full for any other degree/diploma at this or any other university/institute. The dissertation is fit to be considered for evaluation for award of the degree of Master of physiotherapy.

Signature of Supervisor	**Principal**
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Project work evaluated on _____

DECLARATION

The work embodied in the thesis entitled **"A STUDY ON PEAK EXPIRATORY FLOW RATE IN PATIENTS WITH TYPE II DIABETES MELLITUS"** submitted to **The Tamilnadu Dr. MGR Medical University, Chennai**, in partial fulfillment for the degree of Master of Physiotherapy, was the original work carried out by me and has not been submitted in part or full for any other degree/diploma at this or any other university/institute. All the ideas and references have been duly acknowledged.

Signature of the Supervisor
Mrs.I.Sheeba francino MPT
Professor

Signature of student

Date: _____

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Mr.N.MAGESWARAN

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ABSTRACT

Objective

To compare the peak expiratory flow rate of diabetic patients with normal populations and to study the association of duration of diabetes mellitus, fasting blood sugar value in relation to Peak Expiratory Flow Rate.

Study Design

Descriptive study, prospective randomized design

Setting

Priya clinic and diabetic center, combatore.

Participants

50 diabetic females and 50 normal populations.

Methods

50 Type 2 diabetic and 50 normal populations were selected. Their fasting blood sugar values, PEFR, duration of diabetes, anthropometric details were collected & documented. PEFR values between diabetic & controls were compared.

Results

Peak expiratory flow rate is significantly higher for diabetics compared to controls (‘t’ test value 26.810 significant at 0.01 level). There is significant association, significant at .01 level) ie PEFR is less as duration of diabetes is more. But there is no association between the value of FBS and PEFR (‘r’ value is -.176).

Conclusion

Peak expiratory flow rate is significantly reduced in diabetics when compared to controls ($P<0.01$) group participants. There is a significant associated between the duration of diabetes and PEFR ($P<0.01$), An inverse relationship was found between the PEFR and the duration of diabetes, PEFR was found to be low in the participants with longer duration of diabetes and vice versa. There was no association between the fasting blood sugar and PERF in diabetic patients

Key words

Peak expiratory flow meter, Type II diabetes mellitus, fasting blood sugar, body mass index.

EXPLANATION FOR ABBREVIATION

DM	**:** Diabetes mellitus
PEFR	: Peak expiratory flow rate
BL	: Basal lamina
FVC	: Forced vital capacity
FEV1	: Forced expiratory volume in one second
DLCo	: Diffusion capacity for carbon monoxide
FBS	: Fasting blood sugar
TLC	: Total lung capacity
NIDDM	: Non insulin dependent diabetes mellitus
PFT	: Pulmonary function test
PaO2	: Partial pressure of oxygen
PaCO2	: Partial pressure of carbon dioxide
BMI	: Body mass index

ABSTRACT

Objective

To compare the peak expiratory flow rate of diabetic patients with normal populations and to study the association of duration of diabetes Fasting blood sugar value in relation to Peak Expiratory Flow Rate.

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Descriptive study, comparative method.

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→ Diabetic OP of RMMCH
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Peak expiratory flow rate is significantly higher for diabetics compared to controls ('t' test value 26.810 significant at 0.01 level). There is significant association, significant at .01 level) ie PEFR is less as duration of diabetes is more. But there is no association between the value of FBS and PEFR ('r' value is -.176).

Conclusion

Peak expiratory flow rate is significantly reduced in diabetics compared to controls and there is strong association exists between duration of diabetes and peak expiratory flow rate, ie. as duration of diabetes is more PEFR is less.

INTRODUCTION

Diabetes mellitus is a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of insulin[1]. Type 2 diabetes mellitus is a serious, progressive condition associated with number of chronic complications that are mainly a consequence of macro vascular & micro vascular damage[2]. Cardiovascular disease, nephropathy, diabetic retinopathy, neuropathy and lung damage are the important complications of diabetes mellitus[3].

Evidence[3, 4, 5, 6] supports the involvement of lungs in subjects with diabetes mellitus. Thickened alveolar walls, alveolar capillary walls, the pulmonary arteriolar walls has been observed in diabetes mellitus[3,4]. Collagen, elastic changes as well as has also identified in diabetes mellitus[7]. Elastic structure of the lung supports the intrathoracic airways & helps to maintain their patency. Hence patients with diabetes are at risk for developing chronic airflow obstruction (suggested by Michal David Gold man) [7].

Peak Expiratory Flow Rate (PEFR) is the highest flow that can be achieved during a forced expiration from maximal inspiration[8]. It measures the ease with which the lungs are resistance in the large airways and expiratory muscle strengths effort[8]. The PEFR can be measured using a wright's peak flow meter. It is one of the simplest way of measuring serial changes in airways obstruction over a period of time[9].

Contrary report has been obtained in the relationship between pulmonary function and diabetes mellitus. While some authors have reported normal pulmonary function[10] others found abnormalities in lung volumes, pulmonary mechanism & diffusing capacity[11, 12, 13, 14, 15].

Moreover the relationship like duration of diabetes, age, height, and weight with lung function has not explained in many studies. Hence the aim of the present study is to compare the peak expiratory flow Rate of Diabetic patients with normal populations.

REVIEW OF LITERATURE

1. Abdul Majeed AI Dress et al[16] in their work on "Lung function in type 2 Saudi diabetic patients" studied the effects of type 2 diabetes mellitus on lung function and to determine its gravity in relation to duration of disease. 32 healthy type II diabetic patients were randomly selected with age ranging from 24-73 years. They were matched with another 40 control healthy male subjects in terms of age, height and weight. In conclusion lung function in type 2 diabetic patients is impaired by a decrease in FVC, PEF as compared to their matched controls.

2. Sanjeev Sinha et al[17] evaluated pulmonary functions including respiratory muscle strength in patients with type 2 Diabetes mellitus and to determine their correlations with anthropometric profile, glycemic control, microangiopathic diabetic complications. The result shows that there was no difference among the three groups for FVC, FEV & PEFR. The study shows that the impairment of pulmonary diffusion capacity for carbon monoxide was common in type II diabetes mellitus in Asian Indian Patient having microangiopathy.

3. Niranjan , et al[19], studied cardiopulmonary function during exercise in young subjects with long standing insulin-dependent diabetes mellitus who have no clinical cardiopulmonary disease to determine the relationships of aerobic capacity , gas exchange, ventilatory power requirement and cardiac output to chronic glycemic control. The result shows that Maximal work load & oxygen uptake were markedly impaired in chronically hyperglycemic diabetic patients associated with significant restriction of lung volume, Lung diffusing capacity and stroke index during exercise. Membrane diffusing capacity was significantly reduced at a given cardiacindex. The normoglycemic patients consistently showed less impairment than the hyperglycemic patients.

4. Benbassat CA et al[20], did work on "pulmonary function in patients with diabetes mellitus" studied the pulmonary function in a group of patients with diabetes using a combined cardiopulmonary exercise test. The result shows that the spirometric values are preserved in patients with diabetes mellitus and there is no defect in diffusing capacity. Cardio vascular factors may account for impaired physical performance.

5. Boulbou MS, et al[21], did the study to explore the possible relationship between lung function and circulating levels of adhesion molecules in diabetes. They

concluded that the diabetic subjects showed lower pulmonary volumes and variation in DLCO by changing posture from sitting to supine position, and they also show increased levels of E-selectin. A possible explanation is impaired pulmonary microvasculature, because adhesion molecules seen to be sensitive markers of endothelial activation and damage seen in diabetes.

6. Boulbou MS, et al[22], assessed the nature of pulmonary dysfunction in type 1 diabetes and the relationship of pulmonary function tests to diabetic factors and complications. This study indicates that type 1 diabetic patients have reduced TLC & DL (CO) features of pulmonary restrictive dysfunction. There was no correlation between abnormal pulmonary function and the presence of other diabetic complications.

7. Makkar.P, et al[26], studied the ventilator pulmonary function tests (VPFT) in type one diabetes mellitus and to correlate it with duration, meticulous metabolic control and various complications of diabetes. The result shows that spirometric evaluation in type one diabetes mellitus showed varying derangements in the different parameters of PFTS, suggestive of dominantly restrictive with some obstructive pattern as indicated by significant decline in FVC, PEFR and MEF 15%.

8. Wendy A. Davis[27] examined prospectively the relationship between diabetes glycemic control and spirometric measures. The result shows there was reduced lung volumes and air flow limitation are likely to be chronic complications of type 2 diabetes, the seventy of which relates to glycemic exposure. Airflow limitation is a predictor of death in type 2 diabetes after adjusting for other recognized risk factors.

9. Maurizio Marvisia et al[28], assessed the presence of pulmonary function abnormalities in patients with NIDDM and to verify the possible associations between diabetic renal microangiopathy, retinopathy and diabetes control they concluded that pulmonary function abnormalities in particular a reduction in diffusion capacity are common in patients with NIDDM and signs of diabetes microangiopathy.

10. .Kemal ozsahina et al[29] detected the function and permeability of alveolar basement membrane using carbon monoxide diffusion capacity and technetium 99m.diethyltriaaminepenta acetic acid (99m Tc-DTPA) aerosol scintigraphy methods. Authors aimed to determine the alveolar basement

membrane damage using these two methods. Carbone monoxide diffusion capacity showed no difference between the two groups. Aerosol scintigraphy was significantly decreased in the diabetes group and alveolar capillary permeability was significantly decreased than in control group. The permeability of alveolar basement membrane can reduce in respect to diabetes duration and poor metabolic control.

11. M Sandler, et al[5], clarified the issue of pulmonary dysfunction in diabetes mellitus; lung mechanics & Co transfer were investigated in 22 young non-smoking, insulin dependent diabetic patients and an equall number of matched healthy subjects. The transfer factor expressed per unit alveolar volume was also significantly lower in diabetic than in the control group. There was evidence of mild abnormal lung mechanics and or a decreased pulmonary capillary blood volume in 16 (73%) of the diabetic group.

12. Matsubara T, et al[6], examined the pulmonary function and microscopic change of the lungs of diabetic patients compared with those of non-diabetic patients to assess the diabetic microangiopathy in lungs. The alveolar capil' walls, the pulmonary arteriolar walls and the alveolar walls had thickened significantly in the diabetic patients.

METHODOLOGY

Aim

To compare the peak expiratory flow rate of diabetic patients with normal populations and to study the association of duration of diabetes Fasting blood sugar value in relation to Peak Expiratory Flow Rate.

Study Design

Descriptive study, comparative method.

Settings

→ Diabetic OP of RMMCH
→ Division of PMR, RMMCH

Participants

50 diabetic females & 50 controls.

Methods

Study purpose & procedures were explained to each subject. A prior informed written consent was obtained. Diabetic patients were selected randomly from the outpatient department of diabetes from RMMCH Annamalai University. Controls were chosen from the sample population in & around Chidambaram town.

Selection Criteria

- Age Group 40 – 75 years.
- Only females were selected.
- Only type 2 diabetes patients were included
- Subjects with associated Respiratory disorders were not selected
- Obese participants and those were involved in regular exercise were not chosen

Measurement Tools

Peak Expiratory flow rate was measured in liters/second using mini wright's peak flow meter. The subjects were instructed to blow the air as fast as possible through the device after taking maximal inspiration. Best of the 3 readings was recorded.

Fasting blood sugar was noted from the recent readings of the case sheet, where as readings for controls were measured using glucometer.

Information regarding the age of the subject and duration of diabetes mellitus was recorded in the proforma. The relationship between diabetes mellitus and peak expiratory flow rate in association with FBS value and duration of diabetes were analyzed with the help of statistical tools.

STATISTICAL ANALYSIS

Table 1
Showing t-test for Diabetic and Control group with PEFR Score

Groups	N	Mean	SD	t-value	P value
Diabetic	50	186.80	29.58	26.810	0.000 (P<0.01)
Control	50	334.60	24.51		

SD – Standard Deviation **P value** – Probability value

The t-value is found to be 26.810 and it is greater than the table value of 2.57. Hence it is significant at 0.01 level. Therefore the stated alternate hypothesis is accepted and null hypothesis is rejected. So it is concluded that there is a significant difference between Diabetic and Control group with PEFR scores.

Table 2
Correlation between Durationof diabetes and PEFR

	PEFR
Duration	-0.602**

** Correlation is significant at the 0.01 level

The above correlation result shows that there is a negative and significant relationship between the Duration and PEFR (-0.602). This indicates that there is a relationship among the factors.

Comparison between Duration of diabetes and PEFR

To find out the significance difference between the mean of Duration of diabetes and PEFR , 't' test was applied and the results are presented in table.

Showing t-test for Duration of diabetes and PEFR

Groups	N	Mean	SD	t-value	P value
Duration	50	5.02	2.71	40.932	0.000 (P<0.01)
PEFR	50	186.60	29.67		

SD – Standard Deviation **P value –** Probability value

The t-value is found to be 40.932 and it is greater than the table value of 2.57. Hence it is significant at 0.01 levels. Therefore the stated alternate hypothesis is accepted and null hypothesis is rejected. So it is concluded that there is a significant difference between Duration and PEFR group.

Table 3
Correlation between FBS and PEFR Score

	PEFR
FBS	-0.176

The above correlation result shows that there is a negative and no significant relationship between the FBS and PEFR (-0.176). This indicates that there is a no relationship among the factors.

Table 4
Comparison between Diabetic & Control group with BMI Score

To find out the significance difference between the mean of Diabetic and Control group with BMI score, 't' test was applied and the results are presented in table.

Showing t-test for Diabetic and Control group with BMI Score

Groups	N	Mean	SD	t-value	P value
Diabetic	50	22.22	2.60	0.735	0.466 (P>0.01) NS
Control	50	22.68	3.56		

SD – Standard Deviation **NS** – Not significant **P value –** Probability value

The t-value is found to be 0.735 and it is less than the table value of 2.57. Hence it is not significant. Therefore the stated alternate hypothesis is rejected and null hypothesis is accepted. So it is concluded that there is a no significant difference between Diabetic and Control group with BMI scores.

DISCUSSION

In the present study, the relationship between type 2 DM & PEFR were studied. In addition, whether there is any relationship exists between duration of diabetes, level of FBS & PEFR is also analyzed. The current study results demonstrated that there is significant relationship between diabetes & PEFR .ie. PEFR is significantly lower in diabetic females compared to controls. Moreover as duration of diabetes is more the further reduced. But there is no significant relationship between level of FBS value and PEFR ie., PEFR is not dependent upon the level of FBS value.

In the present study PEFR is chosen as outcome measure for measuring pulmonary function because PEFR is measured with the help of simple Wright's Peak Expiratory Flow meter device & it is cost effective too. The previous investigations of lung status in diabetes demonstrated that there is a collagen and elastic change observed in the airways which may result increased airway resistance &expiratory flow rate of air flow. The above findings support the use of PEFR as a tool for the study.

The current study is correlated with Abdul Majeed Al Dress et al. They all demonstrated significant decrease in PEFR for diabetes .The other common parameters of Ventilatory function examined in previous studies are carbon

monoxide diffusion capacity, MEF &thickening of the pulmonary basal lamina. But very few studies have examined the relationship between duration of diabetes, level of FBS & PEFR. The current study results show that there is strong relationship between duration of diabetes & PEFR. When duration of diabetes is high, there is significant decrease in PEFR value. No significant difference was observed for level of FBS score and PEFR. Hence duration of diabetes has further detrimentional effect of diabetic lung.

In the current study BMI & Age of the diabetics & controls are matched in order to prevent extraneous variable influencing study results. It is recommended to study the other lung function parameters, most in future to determine the impact of diabetes on lung function. It is further suggested to include more study sample, both sexes & Type 1 diabetes to better analyze the performance of lung function to identify the possible mechanism.

CONCLUSION

Peak expiratory flow rate is significantly reduced in diabetics compared to controls and there is strong association exists between duration of diabetes and peak expiratory flow rate, ie. as duration of diabetes is more PEFR is less.

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INTRODUCTION

Diabetes mellitus is a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of insulin[1]. Type 2 diabetes mellitus is a serious, progressive condition associated with number of chronic complications that are mainly a consequence of macro vascular & micro vascular damage[2]. Cardiovascular disease, nephropathy, diabetic retinopathy, neuropathy and lung damage are the important complications of diabetes mellitus[3].

Evidence [3, 4, 5, 6] supports the involvement of lungs in subjects with diabetes mellitus. Thickened alveolar walls, alveolar capillary walls, the pulmonary arteriolar walls has been observed in diabetes mellitus[3,4] .Collagen, elastic changes as well as microangiopathy of lungs has also identified in diabetes mellitus[7]. Elastic structure of the lung supports the intrathoracic airways & helps to maintain their patency. Hence patients with diabetes are at risk for developing chronic airflow obstruction (suggested by Michal David Gold man) [7].

Peak Expiratory Flow Rate (PEFR) is the highest flow that can be achieved during a forced expiration from maximal inspiration[8]. It measures the ease with which the lungs are resistance in the large airways and expiratory muscle strengths effort[8]. The PEFR can be measured using a wright's peak flow meter. It is one of the simplest ways of measuring serial changes in airways obstruction over a period of time[9].

Contrary report has been obtained in the relationship between pulmonary function and diabetes mellitus. While some authors have reported normal pulmonary function[10] others found abnormalities in lung volumes, pulmonary mechanism & diffusing capacity[11, 12, 13, 14, 15].

Moreover the relationship like duration of diabetes, age, height, and weight with lung function has not explained in many studies. Hence the aim of the present study is to compare the peak expiratory flow Rate of Diabetic patients with normal populations.

STATEMENT OF PROBLEM

There is a alarming increase in the incidence and prevalence of diabetes mellitus particularly in Asian Indian. Many of the recent studies have shown that several pathological changes may affect the lungs in patients with type 2 diabetes mellitus.

The histo-pathological evidence of the involvement of lung in subjects with DM showed thickened alveolar walls, alveolar capillary walls and the pulmonary arteriolar walls.

Peak expiratory flow rate is significantly reduced in diabetics compared to controls and there is strong association exists between duration of diabetes and peak expiratory flow rate , i.e duration of diabetics is more peak expiratory flow rate is less.

There are changes in collagen and elastic component of lungs in diabetes. Hence, the correlation between lung function and DM need to be studied.

NEED FOR THE STUDY

Type 2 Diabetes mellitus is increasing worldwide at an alarming rate and associated with number of chronic complications. It is more common in 40-70 years of age and approximately 10% to 25% of women's are afflicted by this type 2 diabetes mellitus.

Though so many approaches are used to analyze the pulmonary function test in diabetes mellitus patients. Few studies have done effectiveness of lung function test in type 1 diabetes mellitus like eg:

Boulbou MS, et al[22], assessed the nature of pulmonary dysfunction in type 1 diabetes and the relationship of pulmonary function tests to diabetic factors and complications. This study indicates that type 1 diabetic patients have reduced TLC & DL (CO) features of pulmonary restrictive dysfunction. But there is no literature evidence available that has documentation of the effectiveness of peak expiratory flow rate in patients with type 2 diabetes mellitus. Hence the study intended to find whether the peak expiratory flow rate is higher or lower in patients with type 2 DM compared with controls.

OBJECTIVES

To evaluate the peak expiratory flow rate in patients with type 2 diabetes mellitus and to compare the findings with normal populations.

To evaluate the association of duration of diabetes mellitus and to Compare the findings with normal populations.

To evaluate the association of fasting blood sugar value in relation to Peak Expiratory Flow Rate.

AIM OF THE STUDY

To compare the peak expiratory flow rate of diabetic patients with normal populations and to study the association of duration of diabetes mellitus, fasting blood sugar value in relation to Peak Expiratory Flow Rate.

HYPOTHESIS

Null hypothesis

There is no significant difference in peak expiratory flow rate were compared betweens individuals with diabetes mellitus and normal individuals. (H_0)

Experimental hypothesis

There is a significant difference in peak expiratory flow rate were compared betweens individuals with diabetes mellitus and normal individuals. (H_1)

REVIEW OF LITERATURE

'A Study on Lung function in type 2 diabetes mellitus patients' Evaluated the effects of type 2 diabetes mellitus on lung function and to determine its gravity in relation to duration of disease. 32 healthy type II diabetic patients were randomly selected with age ranging from 24-73 years. They were matched with another 40 control healthy male subjects in terms of age, height and weight. In conclusion lung function in type 2 diabetic patients is impaired by a decrease in FVC, PEF as compared to their matched controls .**Abdul Majeed Dress et al**[16]

A study evaluated pulmonary functions including respiratory muscle strength in patients with type 2 Diabetes mellitus and to determine their correlations with anthropometric profile, glycemic control, microangiopathic diabetic complications. The result shows that there was no difference among the three groups for FVC, FEV & PEFR. The study shows that the impairment of pulmonary diffusion capacity for carbon monoxide was common in type II diabetes mellitus in Asian Indian Patient having microangiopathy. **Sanjeev Sinha et al**[17] **(2004)**

A study by Ramirez et al ., evaluated the effect of different levels of glycemic control on the pulmonary function of subjects with type 1 insulin-dependent diabetes mellitus. Eighteen subjects with type 1 insulin-dependent diabetes mellitus with no history or physical findings of respiratory disease were chosen for the present study. Patients with insulin therapy with a standard twice-daily insulin injection regimen

(standard treatment group) and a subcutaneous insulin infusion device using insulin pump (intensive treatment group) were studied. Glycosylated hemoglobin (HbA1c) levels were determined at quarterly intervals in both groups of patients (standard of group, n=10; intensive treatment group, n=8). Pulmonary function and diffusing capacity for carbon monoxide (DLCO) were measured after 6 years of continuous follow-up. They stated that the diffusing capacity for carbon monoxide (DLCO) was significantly diminished in the standard treatment group as compared with that in the intensive treatment group. **Ramirez, et al [18] (1997)**

A study by Niranjan, et al suggested cardiopulmonary function during exercise in young subjects with long standing insulin-dependent diabetes mellitus who have no clinical cardiopulmonary disease to determine the relationships of aerobic capacity , gas exchange, ventilatory power requirement and cardiac output to chronic glycemic control. The result shows that Maximal work load & oxygen uptake were markedly impaired in chronically hyperglycemic diabetic patients associated with significant restriction of lung volume, Lung diffusing capacity and stroke index during exercise. Membrane diffusing capacity was significantly reduced at a given cardiacindex. The normoglycemic patients consistently showed less impairment than the hyperglycemic patients. **Niranjan , et al[19] (2001)**

A study by Benbassat et al assessed the pulmonary function in a group of patients with diabetes using a combined cardiopulmonary exercise test. The result shows that the spirometric values are preserved in patients with diabetes mellitus and there is no defect in diffusing capacity. Cardio vascular factors may account for impaired physical performance. **Benbassat et al[20] (2003)**

Boulbou et al concluded that the diabetic subjects showed lower pulmonary volumes and variation in DLCO by changing posture from sitting to supine position, and they also show increased levels of E-selectin. A possible explanation is impaired pulmonary microvasculature, because adhesion molecules seen to be sensitive markers of endothelial activation and damage seen in diabetes. **Boulbou, et al[21] (2003)**

A study by Boulbou et al assessed the nature of pulmonary dysfunction in type 1 diabetes and the relationship of pulmonary function tests to diabetic factors and complications. This study indicates that type 1 diabetic patients have reduced TLC & DL (CO) features of pulmonary restrictive dysfunction. There was no correlation between abnormal pulmonary function and the presence of other diabetic complications. **Boulbou, et al[22] (2001)**

A study by Marvis et al aimed to assess the presence of pulmonary function abnormalities in patient with NIDDM & to verify the possible association between diabetic renal microangiopathy, retinopathy and diabetes control. They concluded that

pulmonary function abnormalities in particular a reduction in diffusion capacity are common in patient with NIDDM and signs of diabetic micro angiopathy. A possible explanation is related to an impaired pulmonary micro-vasculature and alveolar epithelia basal lamina. **Marvis, et al [23] (1998)**

A study on Alveolar gas exchange patients with type 2 diabetes mellitus was conducted to quantify and compare the capacity of gas exchange in patients with type 2 diabetes mellitus and healthy controls and also to investigate the effects of various factor on alveolar capillary permeability. This study demonstrated the decreased alveolar gas exchange capacity in diabetes patients compared with healthy controls. **Guvener, et al[24] (1999)**

A study was done to examin the relationship between diabetes glycemic control and spirometric measures. Devis et al concluded that the reduced lung volumes and airflow limitation are likely to be chronic complication of type 2 diabetes, the severity of which relates to glycemic exposure. **Davis et al[25]**

The spirometric evaluation in type one diabetes mellitus showed varying derangements in the different parameters of PFTS, suggestive of dominantly restrictive with some obstructive pattern as indicated by significant decline in FVC, PEFR and MEF 15%. **Makkar., et al[26] (2009)**

A study by Wendy A. Davis et al examined prospectively the relationship between diabetes glycemic control and spirometric measures. The result shows there was reduced lung volumes and air flow limitation are likely to be chronic complications of type 2 diabetes, the seventy of which relates to glycemic exposure. Airflow limitation is a predictor of death in type 2 diabetes after adjusting for other recognized risk factors. **Wendy A. Davis[27] (2003)**

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In a study on Evaluation of pulmonary alveolar- capillary permeability in type 2 DM authors aimed to determine the alveolar basement membrane damage using these two methods. Carbone monoxide diffusion capacity showed no difference between the two groups. Aerosol scintigraphy was significantly decreased in the diabetes group and alveolar capillary permeability was significantly decreased than in control group. The permeability of alveolar basement membrane can reduce in respect to diabetes duration and poor metabolic control. **Kemal ozsahina et al[29] (2003)**

A study on the relationship between pulmonary complications and other chronic complications in diabete the finding indicates that both renal and pulmonary complications of diabetes share a similar microangiopathic background. **Ljubic, et al[30] (2003)**

In a study on Diabetes mellitus induce a thickening of the pulmonary basal lamina it was found that all parts of the lung are equally affected by Diabetes Mellitus. The thickening of BL is of the same magnitude in lung and kidney. There is no relationship between the thickening of the lung BL and know duration and type of DM. **Weynand, et al[31]**

The possible associations between diabetes mellitus, plasma glucose, forced vital capacity and forced expiratory volume in one second was evaluated in a study by Lange et al all age groups of diabetic subjects there was a slight impairment of lung function and there was a significant association between reductions in lung function and raised plasma glucose concentration. **Lange et al[32]**

A study examined the association between the vascular complications of diabetes and changes in pulmonary function. The % Diffusion capacity for carbon monoxide decreased significantly as the duration of diabetes increased. The reduction in other pulmonary function tests (% VC, FEV_1 P_aO_2 & P_aCO_2) showed no relationship

to the duration of diabetes, the degree of microangiopathy or the type of treatment. **Hiroshi mori, et al[33] (1992)**

A study clarified the issue of pulmonary dysfunction in diabetes mellitus; lung mechanics & Co transfer were investigated in 22 young non-smoking, insulin dependent diabetic patients and an equall number of matched healthy subjects. The transfer factor expressed per unit alveolar volume was also significantly lower in diabetic than in the control group. There was a evidence of mild abnormal lung mechanics and or a decreased pulmonary capillary blood volume in 16 (73%) of the diabetic group. **Sandler, et al[5] (1986)**

In a study by Matsubara et al, they examined the pulmonary function and microscopic change of the lungs of diabetic patients compared with those of non-diabetic patients to assess the diabetic microangiopathy in lungs. The alveolar capillary walls, the pulmonary arteriolar walls and the alveolar walls had thickened significantly in the diabetic patients. **Matsubara, et al[6] (1991)**

METHODOLOGY

Study Design

Descriptive study, prospective randomized design.

Settings

Priya clinic and diabetic center, Coimbatore.

Sampling size

→ 50 diabetic females

→ 50 normal population

Sampling group

→Group A → 50 diabetic females

→Group B → 50 normal population

Method

Study purpose & procedures were explained to each subject. A prior informed written consent was obtained. Diabetic patients were selected randomly from the diabetic center in (priya clinic/ diabetic center, coimbatore). Normal populations were chosen from the sample population in & around the Coimbatore town.

Materials needed

- Mini wright's peak flow meter
- Disposable mouth pieces
- Proforma sheet and pen

Procedure

- Attached new disposable mouth piece to the peak flow meter
- Before each use make sure the sliding pointer on the peak flow meter is reset to zero mark.
- Ask the participant to stand up and hold the peak flow meter in horizontal position.
- Take care not to place the fingers over the scale
- Ask the participants now to take a deep breath in and make a tight seal with their lips around the mouth piece.
- Now, ask the participants to blow out as hard and as fast as they can.
- Note the number where the sliding pointer has stopped on the scale
- Reset the pointer to zero
- Repeat this procedure in five times
- Record the best of the three trails

Inclusion criteria

- Age Group 40 – 75 years
- Only females were selected
- Only type 2 diabetes patients were included
- Only AGE matched BMI matched normal subjects were included for control population

Exclusion criteria

- Subjects with associated Respiratory disorders were not selected
- Obese participants and those were involved in regular exercise were not chosen
- Type 1 diabetic patients were excluded
- BMI greater than 30 were not chosen
- Pregnancy women were not chosen

MEASUREMENT TOOLS

Peak Expiratory flow rate

It was measured in liters/second using mini wright's peak flow meter. The subjects were instructed to blow the air as fast as possible through the device after taking maximal inspiration. Best of the 3 readings was recorded.

Fasting blood sugar

It was noted from the recent readings of the case sheet; where as readings for controls were measured using glucometer.

Anthropometric measurement

This like height & weight was measured using measuring tape and weighing machine respectively. BMI was calculated by the formula

$$\frac{\text{Weight in kg}}{\text{Height in m}^2}$$

Information regarding the age of the subject and duration of diabetes mellitus was recorded in the proforma. The relationship between diabetes mellitus and peak expiratory flow rate in association with FBS value and duration of diabetes were analyzed with the help of statistical tools.

STATISTICAL TOOLS

In the study, the two groups were compared for the significant difference to infer the effect of peak expiratory flow rate in patients with type II diabetic mellitus. The statistical tool used in this analysis was paired‘t’ test and correlation, the difference of values between diabetic and normal populations were found the mean difference of PEFR of group A were compared with group B and correlation of duration and FBS were compared with the PEFR in diabetics patients with the acquired‘t’ value and the accurate level of significance was analyzed and interpreted.

ARITHMETIC MEAN

The mean of the values was calculated using the formula given below:

$$\bar{X} = \Sigma x / N$$

Where,

$\bar{X}$ = Arithmetic Mean,

Σx = Sum of all variables,

N = Total number of variables.

STANDARD DEVIATION

The standard deviation was calculated using the formula given below

$$S.D = \frac{\sqrt{\sum(X-X_1)^2}}{\sqrt{N}}$$

where, X_1 = Arithmetic Mean,

X = Sum of all variables

N = Total number of variables.

PAIRED 't' TEST:

$$T = \frac{\overline{X}}{\sqrt{s^2/n}}$$

$\overline{X}$ = Mean difference

S^2 = Sample variance

n = Total numbers

CORRELATION

$$\text{'r' Value (r)} = \frac{\sum(X_i - X_{mean})(y_i - y_{mean})}{\sqrt{\sum(X_i - X_{mean})^2}\ \sqrt{\sum(y_i - y_{mean})^2}}$$

STATISTICAL ANALYSIS

Table 1: Showing t-test for Diabetic and Control group with PEFR Score

Groups	N	Mean	SD	t- value	P- value
Diabetic	50	186.80	29.58	26.810	0.000 (P<0.01)
control	50	334.60	24.51		

SD – **S**tandard **D**eviation **P value** – **P**robability value

The t- value is found to be 26.810 and it is greater than the table of 2.57. Hence it is significant at 0.01 level. Therefore the stated alternate hypothesis is Accepted and null hypothesis is rejected. So it is concluded that there is a Significant difference between Diabetic and Control group with PEFR scores.

Graph 1: Showing mean for diabetic and control group with PEFR Score

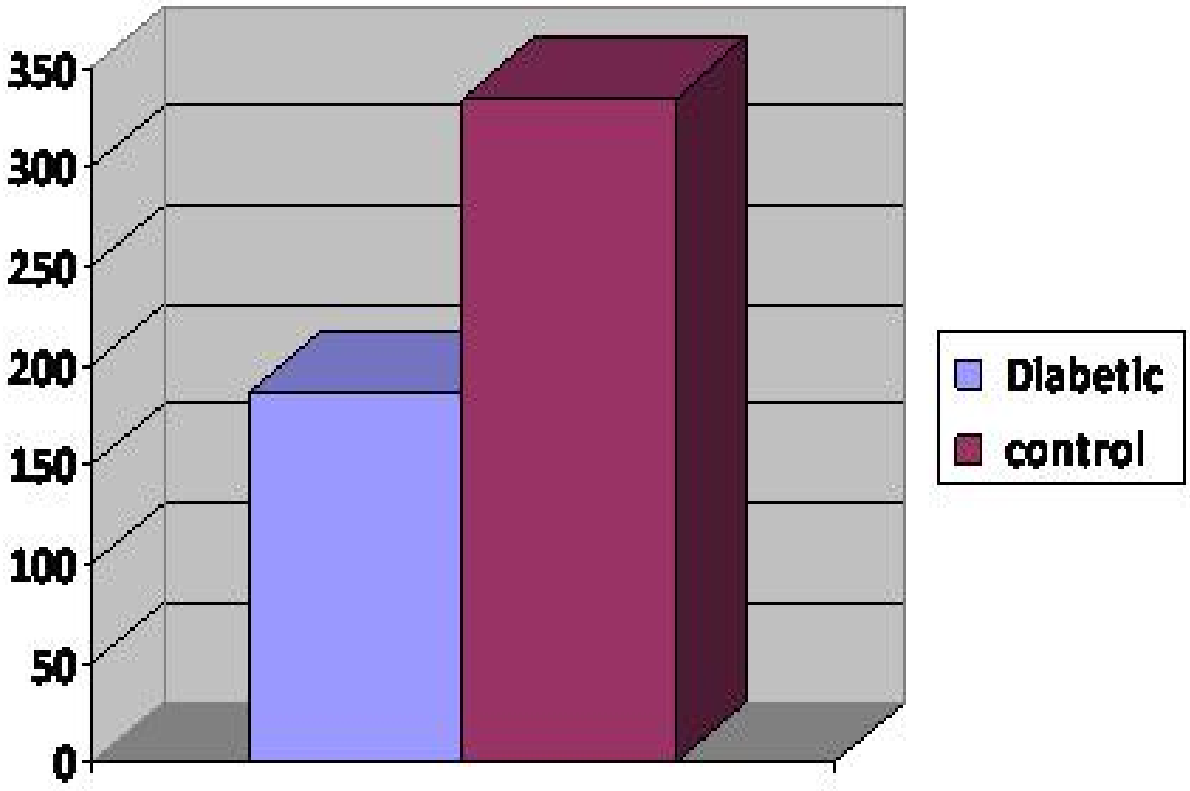


Table 2: Correlation between duration of diabetes and PEFR

	PEFR
Duration	-0.602**

** Correlation is significant at the 0.01 level

Result

The above correlation result shows that there is a negative and significant relationship between the duration and PEFR (-0.602). This indicates that there is a relationship among the factors.

Graph 2: Showing mean for duration of diabetes and PEFR

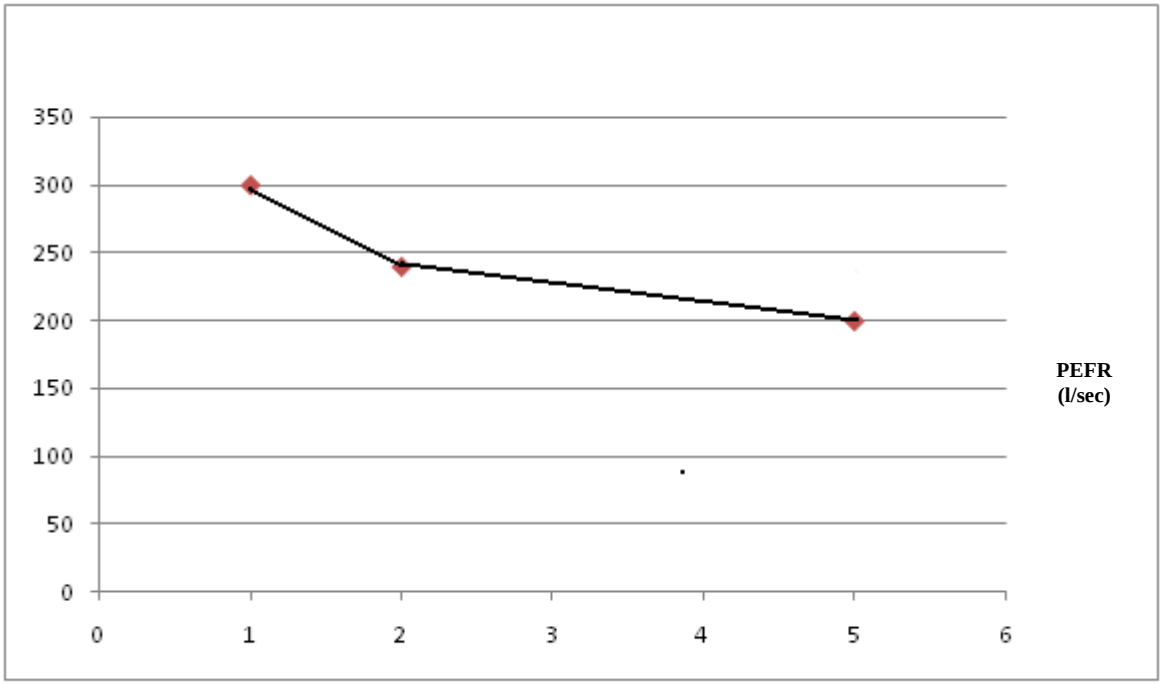


Table 3 : Correlation between FBS and PEFR score

	PEFR
FBS	-0.176

Result

The above correlation result shows that there is a negative and no significant relationship between the FBS and PEFR (-0.176). This indicates that there is a no relation among the factors.

Graph 3 : Showing mean for duration of FBS and PEFR

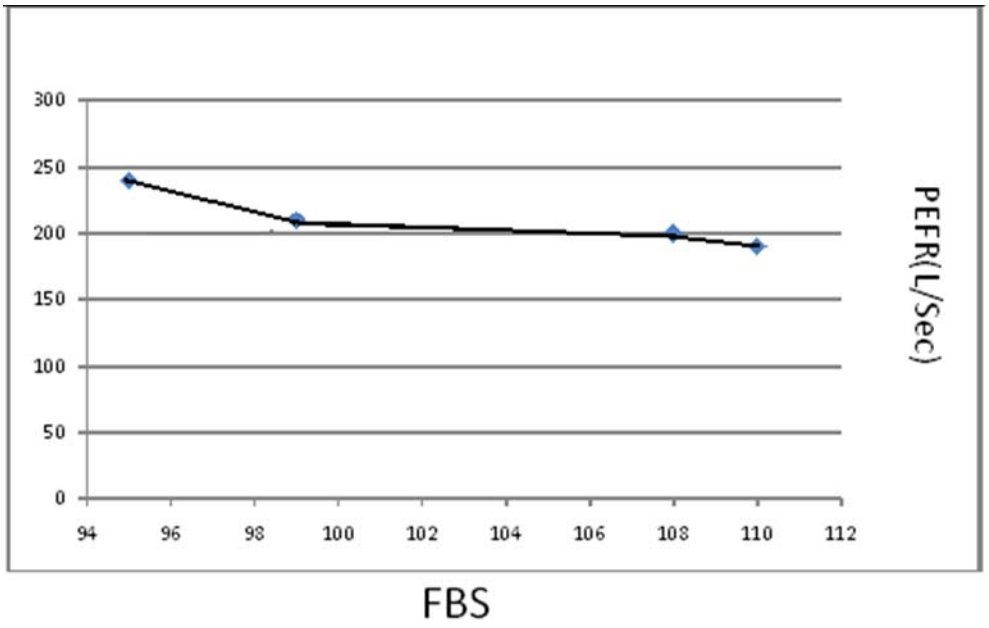


Table 4 : Showing t – test for Diabetic and Control group with BMI score

Groups	N	Mean	SD	t- value	P- value
Diabetic	50	22.22	2.60	0.735	0.466 (P>0.01) NS
control	50	22.68	3.56		

SD -- Standard **D**eviation **NS** – **N**ot **S**ignificant **P Value** – **P**robability value

Result

The t- value is found to be 0.735 and it is less than the table value of 2.57. Hence it is not significant. Therefore the stated alternate hypothesis is rejected and null hypothesis is accepted. So it is concluded that there is a no significant difference between Diabetic and Control group with BMI scores.

Graph 4: BMI Score for Diabetics and Control Group Participants

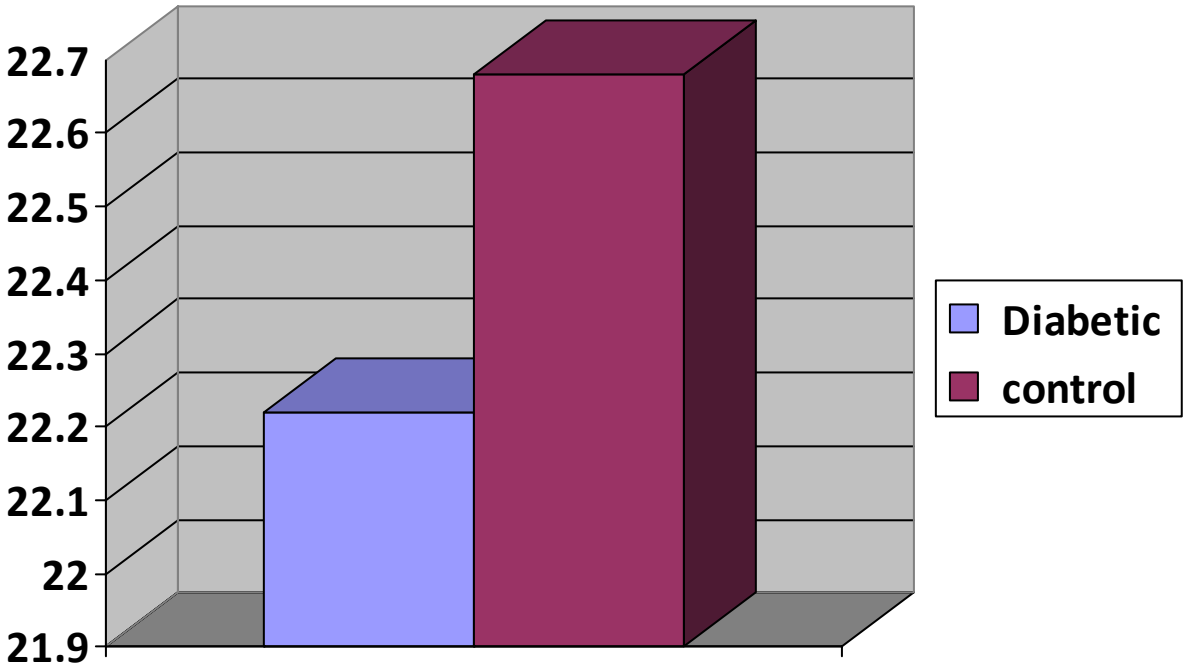


Table 5 : Showing t – test for Diabetic and Control group with age score

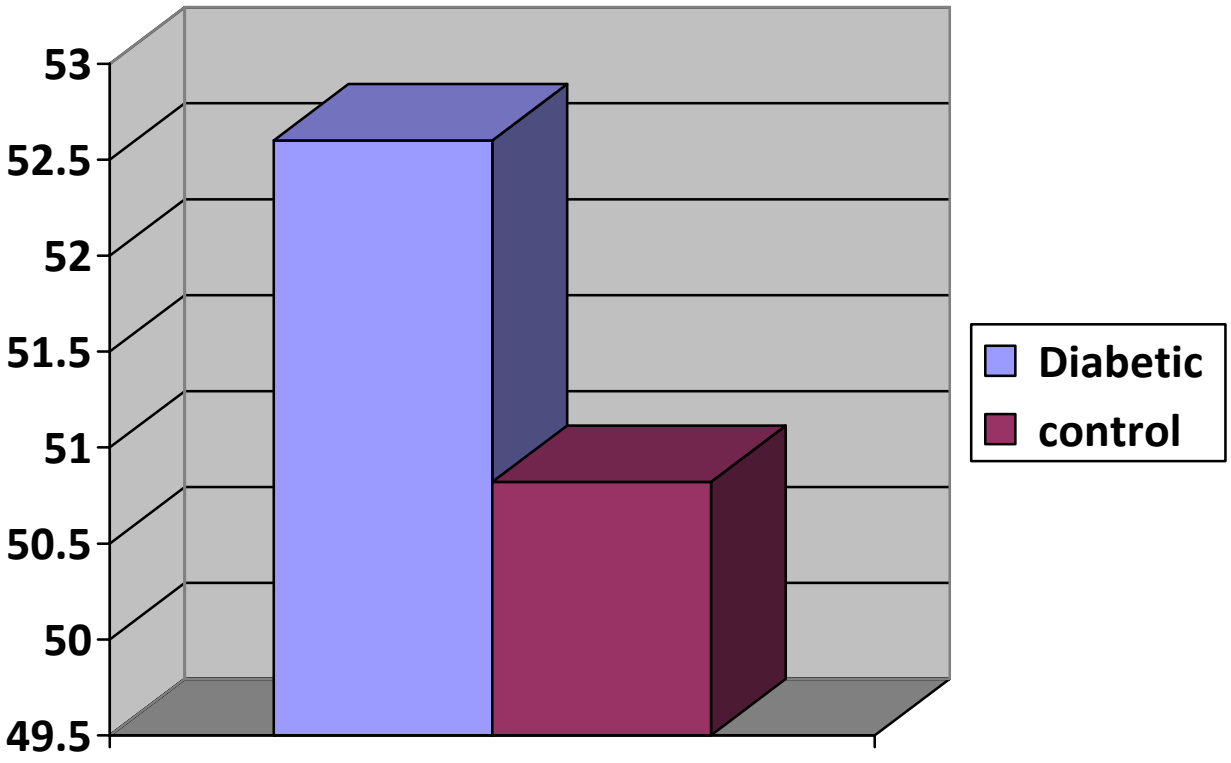
Groups	N	Mean	SD	t- value	P- value
Diabetic	50	52.60	10.01	0.855	0.397 (P>0.01) NS
control	50	50.82	8.55		

SD -- Standard **D**eviation **NS** – **N**ot **S**ignificant **P Value** – **P**robability value

Results

The t- value is found to be 0.855 and it is less than the table value of 2.57. Hence it is not significant. Therefore the stated alternate hypothesis is rejected and null hypothesis is accepted. So it is concluded that there is a no significant difference between Diabetic and Control group with Age scores.

Graph 5: Age Score for Diabetics and Control Group Participants



DISCUSSION

In the present study, the relationship between type 2 DM & PEFR were studied. In addition, whether there is any relationship exists between duration of diabetes, level of FBS & PEFR is also analyzed. The current study results demonstrated that there is significant relationship between diabetes & PEFR .i.e. PEFR is significantly lower in diabetic females compared to controls. Moreover as duration of diabetes is more the PEFR is further reduced. But there is no significant relationship between level of FBS value and PEFR i.e., PEFR is not dependent upon the level of FBS value.

In the present study PEFR is chosen as outcome measure for measuring pulmonary function because PEFR is measured with the help of simple Wright's peak expiratory flow meter device & it is cost effective too. The previous investigations of lung status in diabetes demonstrated that there is a collagen and elastic change observed in the airways which may result increased airway resistance & expiratory flow rate of air flow. The above findings support the use of PEFR as a tool for the study.

The results of current study is concurrent with a study by sanjeev sinha et al., [17] Abdul Majeed AL Dress et al.,[16] Makkar P et al.,[26]. They all demonstrated significant decrease in PEFR of diabetes. The other common parameters of ventilator function examined in previous studies are carbon monoxide diffusion capacity, FEV_1, FVC, MEF & thickening of the pulmonary basal lamina. But very few studies have examined the relationship between duration of diabetes, level of FBS & PEFR. The

current study results show that there is strong relationship between duration of diabetes & PEFR. When duration of diabetes is high, there is significant decrease in PEFR value. No significant difference was observed for level of FBS score and PEFR. Hence duration of diabetes has further detrimentional effect of diabetic lung.

In the current study BMI & Age of the diabetics & controls are matched in order to prevent extraneous variable study results. It is recommended to study the other lung function parameters, most importantly FVC, FEV_1 in future to determine the impact of diabetes on lung function. It is further suggested to include more study sample, both sexes & Type 1 diabetes to better analyze the performance of lung function to identify the possible mechanism.

Therefore the Peak expiratory flow rate is significantly higher for diabetics compared to controls ('t' test value 26.810 significant at 0.01 level). ie PEFR is less as duration of diabetes is more. But there is no association between the value of FBS and PEFR ('r' value is -.176).

CONCLUSION

Peak expiratory flow rate is significantly reduced in diabetics when compared to controls ($P<0.01$) group participants. There is a significant associated between the duration of diabetes and PEFR ($P<0.01$), An inverse relationship was found between the PEFR and the duration of diabetes, PEFR was found to be low in the participants with longer duration of diabetes and vice versa. There was no association between the fasting blood sugar and PERF in diabetic patients.

LIMITATIONS

- Whether the beneficial effects obtained after training will be sustained or not, is not known.
- The study sample size was small.
- This study only with age group between 40-70 years.
- The study was done only on type 2 diabetes mellitus patients.
- Only peak expiratory floe rate meter was used in this study to find out the effects on type 2 DM.

RECOMMENDATIONS

- The result of this study will serve as evidence the effects of peak expiratory flow rate in patients with type 2 DM.
- This study will serve as a reference to further studies in this topic.
- Further research is recommended in a larger sample group.

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APPENDIX –I

PROFORMA (Diabetic group)

DEMOGRAPHIC DATA

Name **:**

Age **:**

Op no **:**

Address **:**

ANTHROPOMETRIC MEASUREMENTS

Height **:** **……..cm**

Weight **:** **……...kg**

BMI **:** **……...kg/m^2**

DIABETIC DETAILS

BLOOD SUGAR VALUE

FBS : ……..mg/dl DOE……....

Duration : ……..years

PEAK EXPIRATORY FLOW RATE **:** ..... Lt/min

SIGNATURE OF THE PATIENT

APPENDIX –II

PROFORMA (Control group)

DEMOGRAPHIC DATA

Name :

Age :

Op no :

Address :

ANTHROPOMETRIC MEASUREMENTS

Height : **……..cm**

Weight : **……...kg**

BMI : **……...kg/m^2**

PEAK EXPIRATORY FLOW RATE : ..... Lt/min

SIGNATURE OF THE PATIENT

APPENDIX --III

Diabetics

SL. NO	Name	PEFR Value	Duration of diabetics	FBS value	BMI	Age
1	Kannamma	300	1	139	23	43
2	Baby	200	4	149	23	50
3	Gangaiammal	180	10	200	18	68
4	rajalakshmi	200	1	150	25	43
5	Ethiammal	180	6	200	17	75
6	Rani	150	4	141	18	38
7	Jayalashmi	130	8	115	25	40
8	Pushpa	190	5	117	26	40
9	Saratha	180	6	137	26	58
10	Bathmavathy	160	6	267	22	68
11	Ratha	180	3	126	21	56
12	Sundharambal	200	4	122	24	65
13	Rahimunisha	150	10	118	17	60
14	Gandhimathy	150	5	144	24	48
15	Sakunthala	200	4	132	22	66
16	Umarani	160	4	102	21	43
17	Vijaya	180	8	141	21	49
18	Rajathi	180	4	167	23	65
19	Shanthi	210	3	120	25	48
20	Jaibunisa	190	5	230	21	55
21	Rajalakshmi	220	3	130	21	48
22	Meenachi	200	5	110	19	58
23	Kasthri	220	3	102	20	42
24	Noornishabee	190	5	160	21	46
25	Anjammal	210	2	99	23	40
26	Manju	200	2	126	22	63
27	Sakunthala	200	5	110	19	40
28	Samsanth	210	3	100	27.5	40
29	Sarasvathy	190	5	105	23	60
30	Lakshmi	200	4	97	25	63

31	Senthamarai	150	14	108	25	58
32	Gnanajothy	140	3	140	24	60
33	Hathambeevi	180	5	118	21	60
34	Valarmathy	230	5	119	20	40
35	Dhavamani	240	2	95	20	40
36	Jaithunbeevi	160	8	125	23	51
37	Amala	200	5	120	19	43
38	Madhuram	200	10	108	24	68
39	Kanagavali	190	5	110	25	55
40	Malavathi	180	3	99	26	48
41	Mariyammal	140	10	140	22	63
42	Malarkodi	180	3	120	22	54
43	Rajeshwari	210	2	140	18	40
44	Kamala	190	5	142	19	58
45	Sugirtha	150	5	130	23	57
46	Manimegali	180	3	130	23	55
47	Thamayanthi	140	10	145	26	63
48	Sugudeena	190	3	125	22	45
49	Thilagam	190	5	120	25	53
50	Mehrjbegam	190	5	111	21	43

APPENDIX --IV

CONTROLS

SL NO	Name	PEFR Value	BMI	Age
1	Suseela	310	22.2	62
2	Kuppammal	300	20	45
3	Sivasutha	380	21	40
4	Selvarani	330	25	50
5	Valli	300	27	48
6	kanagam	310	26	65
7	Rajkumari	320	21	45
8	Vasundara	330	20	62
9	Ambigai	370	21.4	62
10	Saraswathi	350	24	45
11	Sundari	360	26	42
12	Bavani	380	16	50
13	Anushiya	300	20	48
14	Elayarani	280	16	52
15	Senbagavalli	350	18	60
16	Amirthavalli	300	28	56
17	Ganambal	330	24	66
18	Indirani	290	23	60
19	Amirthavalli	290	30	62
20	Suganthy	330	27	50
21	Ganambal	310	17.3	70
22	Malarkodi	320	19	50
23	Malarkodi	310	19	42
24	Sulochana	340	16	40
25	Jagadhambal	350	27	70
26	Kalaivani	360	20	40
27	Bhavani	350	27.6	42
28	Rajeswari	320	30	40
29	Gandhi	330	22.95	47
30	Lashmi	320	22.32	45
31	Dhanalashmi	340	28.5	40

32	Dhanalasmi	330	25	45
33	Sarikitnissa	350	27	40
34	Ananthi	350	23	45
35	Marakatham	320	25	55
36	Meenachi	350	21	52
37	Bharathi	380	21	50
38	Rajayogam	340	21	46
39	Rajakumari	350	23	50
40	Punitha	360	19	45
41	Jayanthi	330	22	45
42	Kasapdayi	340	24	54
43	Vanaja	320	26	49
44	Viji	350	21	50
45	Buvana	340	21	40
46	Thangam	340	23	50
47	Valarmathi	360	21	50
48	Jaya	350	23	55
49	Vasanthi	340	22	58
50	Preethi	370	20	60

CONSENT FORM

I have been informed about the procedures and the purpose of the study. I have understood that I have the right to refuse my consent or withdraw it any time during the study without adversely affecting my treatment. I am aware that being subjected to this study I will have to give my more time for assessments and treatment and these assessments do not interfere with the benefits.

I, _____, the under signed, give my consent to be a participant of this investigations/study program/clinical trial.

Signature of the investigator

Signature of subject

Date:

(Name and address)

APPENDIX --V

From:-

N. Mageswaran

MPT - IInd year [Cardio - Respiratory diseases

Sheerraam's College of Physiotherapy

Coimbatore.

To,

The Doctor,

Priya clinic & Diabetic Centre

Coimbatore.

Respected sir,

Sub:. Permission to take the Patients from Diabetic clinic for dissertation work - Reg.

As a part of my Curriculum I am doing dissertation work on " A STUDY ON PEAK EXPIRATORY FLOW RATE IN PATIENTS WITH TYPE 2 DIABETES MELLITUS". I am in need of subjects who are diabetic (TYPE 2) for Exprimental groups. I am going to measure Peak expiratory flow rate (PEFR) for them in order to compare with ~~the~~ normal Populations. Hence I request you to Permit me to include Prone Diabetic Population attending the clinics/Centre

Thanking you,

Yours faithfully

N. Mageswaran

(N. MAGESWARAN)

Permitted

Dr. R. Rajasekaran, M.B.B.S.D.A., PGDHSC (DIAB)
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Authorised Medical Attendant
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